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Prevalence of High-Risk Food Consumption and Food-Handling Practices among Adults: A Multistate Survey, 1996 to 1997

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ABSTRACT

Risk factors for foodborne diseases include consumption of high-risk foods and unsanitary food-handling practices; however, little is known about the prevalence of these risk factors in the general population. A survey was done in five FoodNet sites (California, Connecticut, Georgia, Minnesota, Oregon) to determine the prevalence of these risk factors in the population. A total of 7,493 adults were interviewed by telephone between 1 July 1996 and 30 June 1997. Results showed that 1.5% drank raw milk, 1.9% ate raw shellfish, 18% ate runny egg, 30% preferred pink hamburger, 93% said they almost always washed their cutting board after cutting raw chicken, and 93% said they almost always washed their hands after handling raw meat or poultry, during 5 days before interview. The results differed by state and demographic group. Consumption of raw shellfish (3.2%) and undercooked hamburger (43%) were more common in Connecticut than other states. Raw milk consumption was more common among people who lived on a farm (8.6%) compared with people who lived in a city or urban area (1.1%). Preference for undercooked hamburger was more common among men (35%), young adults (18 to 25 years, 33%), people with college education (38%), and among people with household income of more than $100,000/year (49%). African-Americans were less likely to prefer undercooked hamburger compared to other racial groups (10% versus 30%). Young adults compared to older adults were less likely to wash their hands after handling raw chicken (88% versus 95%), and men washed their hands less often than women (89% versus 97%). Although there were statistical differences between demographic groups, they are insufficient to warrant targeted educational programs.

An estimated 76 million cases of foodborne disease and 5,000 associated deaths occur each year in the United States *(15)*. The first line of defense against foodborne illness is consumer awareness of high-risk foods and understanding of safe food-handling practices. Outbreak investigations and surveillance for enteric diseases have identified several foods that present high risk for transmission of selected enteric pathogens. Unpasteurized milk has caused a host of enteric infections *(17)*. Undercooked hamburger is recognized as a classic vehicle for *Escherichia coli* O157:H7 infection *(3)*. Raw or runny eggs have caused numerous outbreaks of *Salmonella* serotype Enteritidis infection *(16)*. Raw shellfish has caused outbreaks of hepatitis A and infection by *Vibrio parahaemolyticus* and caliciviruses *(7, 9, 13)*. In recent years, large outbreaks of salmonellosis and *E. coli* O157 infections have been caused by alfalfa sprouts *(6, 14)*. Much media attention accompanied these outbreaks, and public-health officials have striven to alert the public to the dangers associated with these foods. The extent to which people have heard, internalized, and heeded public-health messages about these high-risk foods is unknown, however.

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To design effective educational campaigns, a demographic profile of persons at risk is desirable. Moreover, knowing the background rates of high-risk food consumption and food-handling practices is useful for outbreak investigations and for measuring the effects of interventions. The Foodborne Diseases Active Surveillance Network (FoodNet), established in five states at the time of this study, is the foodborne diseases component of the Emerging Infections Program. To gather information on foodhandling and consumption, we surveyed a random sample of the adult population of the five FoodNet sites.

MATERIALS AND METHODS

FoodNet is a collaborative program among Centers for Disease Control and Prevention, U.S. Department of Agriculture, Food and Drug Administration, and selected state health departments. During the period covered by this report, FoodNet conducted surveillance in selected counties in California, Connecticut, Georgia, and all counties in Minnesota and Oregon *(5, 10)*. The 1995 postcensus estimate of the population within these FoodNet sites was 14.3 million, or 5% of the U.S. population. A telephone survey was conducted between 1 July 1996 and 30 June 1997 in the FoodNet sites. Each month, approximately 130 adults in each site were selected and interviewed using methods similar to those used in the Behavioral Risk Factor Surveillance System *(8, 18)*. Following screening to remove business and nonworking telephone numbers, respondents were contacted using a random-

digit dial, single-stage Genesys-ID sampling method *(8)*. All interviews were conducted in English.

Questions addressed food consumption in the 5 days before the interview, food preferences, food-handling behaviors, history of diarrheal illness in the month prior to interview, reasons for seeking medical care, and demographic characteristics including age, income, education, race, and place of residence. Respondents were asked if they had consumed unpasteurized milk, eaten raw shellfish, undercooked eggs, and alfalfa sprouts in the 5 days before the interview. Three questions about hamburger were included. One question asked how respondents would order their hamburger cooked in a restaurant. They were also asked whether they considered a "cooked" hamburger one that had pink on the inside. Those who answered rare or medium-rare to the first question or those who said "yes" to the latter question were classified as preferring pink or undercooked hamburger. Finally, respondents were asked whether they had eaten pink or undercooked hamburger in the 5 days before the interview. Survey participants were asked how often they washed their hands after handling raw beef or chicken. They were also asked how often they washed their cutting boards after cutting raw chicken. Those who said they "almost always" or "always" washed their hands or their cutting boards after handling raw meat were classified as exercising safe food-handling practices. Unsafe food-handling methods were never or sometimes washing hands or cutting boards after handling raw meat. The U.S. Department of Agriculture mandated that safe cooking and handling labels be placed on all raw meat and poultry products in 1994 *(11)*. Interviewees were asked whether they had seen the safe food-handling label on raw meat and whether or not they had read the label.

Individuals who responded "don't know" or "not sure" or refused to answer a question were excluded from the analysis of the question. The data were weighted to adjust for the respondents' probability of selection, using the number of people per household collected by the survey, and using the Census Bureau's 1995 postcensus estimates of the age- and sex-specific populations of the FoodNet sites. Univariate and bivariate analyses were done using Statistical Product and Service Solutions (SPSS) software *(20)*.

RESULTS

A total of 7,493 adults were interviewed between 1 July 1996 and 30 June 1997. The number of completed interviews in each state varied from 1,369 to 1,630.

The median age of the participants was 41 years. Fifty-two percent were female, 80% were white, 34% were college graduates, 62% had an annual income of less than $60,000, and 41% lived in urban areas (Table 1).

High-risk foods. Very few people had consumed raw milk (1.5%) or raw shellfish (1.9%) in the 5 days before interview (Table 2). Nineteen percent said they had eaten runny eggs, and 7.6% had eaten alfalfa sprouts. Ten precent said they had consumed undercooked hamburger in the 5 days prior to interview, while 30% indicated a preference for undercooked hamburger. Consumption of high-risk foods varied by state. Consumption of raw shellfish (3.2%) and a preference for undercooked hamburger (43%) were more common in Connecticut than in other states. Consumption of alfalfa sprouts was more common in California and Oregon (10.6% and 10.1% respectively).

The prevalence of raw milk consumption was higher among men (2.1%), Hispanics (4.9%), people with <12 years of education (4%), people who earn less than $15,000/year (2.6%), and those who lived on a farm (8.6%) (Table 3). The prevalence of raw shellfish consumption was higher among young adults 18 to 25 years of age (3%), men (2.7%), Hispanics (7.3%), Asians (4.5%), Native Americans (8.9%), and urban dwellers (2.4%). Consumption of undercooked hamburger was higher among men (12.2%) and people with income >$100,000/year (15.3%), whereas the prevalence of this behavior was lower among African-Americans (4.9%) compared to other racial groups (8.5%).

Food-handling practices. Overall, 50% of the respondents said they noticed the safe food-handling label on meat products, and of these, 87% said they had actually read the label.

Seven percent of respondents said they did not always wash their hands after handling raw meat or poultry, and the same percentage of people said they did not always wash their cutting boards after cutting raw chicken.

On the question of food-handling behaviors, young adults (50.4%), males (46.7%), Asians (52%), people with income >$100,000/year (52%), and those who lived in a rural area (51.8%) were less likely to notice the label on meat and poultry (Table 4). When asked about washing hands after handling raw meat, young adults (12.1%), males (11.3%), people with less than 12 years of education (8.3%), and those with income >$100,000/year (9.2%) were more likely to say they do not always wash their hands. This was also true for washing cutting boards after cutting raw chicken. Eighty-eight percent of those who almost always or always washed their hands after handling raw meat had read the safe-cooking and -handling labels on raw meat and poultry, compared to 70% of those who did not always wash their hands. Among those who almost always or always washed their cutting board, 87% had read the label compared to 81% of those who sometimes washed their cutting board after contact with raw chicken (data not shown).

In the 5 days before the interview, women had prepared a median of 8 meals and men 5 meals; and for older adults (≥60 years) it was 10, while young adults (18 to 25 years) prepared a median of 4 meals. The number of meals prepared differed significantly by education and income. Those with less than college education prepared a median of 6 meals, whereas college graduates prepared a median of 5 meals. People who earned less than $60,000/year prepared a median of 6 meals, and for those with annual income >$60,000, it was 5 meals.

DISCUSSION

This survey assessed consumers' knowledge, attitudes, and behaviors surrounding food safety. Geographic and demographic differences in consumer attitudes and behaviors were identified. In general, young adults (18 to 25) and men were more likely to eat high-risk foods and less likely to handle food safely. On average, women prepared more meals than men, and older adults more than young adults.

TABLE 1. *Demographic characteristics of the respondents (%)*

	California (n = 1,445)	Connecticut (n = 1,572)	Georgia (n = 1,630)	Minnesota (n = 1,477)	Oregon (n = 1,369)	Total (n = 7,493)
Age						
18–25	12.4	11.3	13.8	12.1	9.5	11.8
26–39	34.5	30.0	36.7	32.2	31.8	33.1
40–59	32.1	33.0	34.7	32.4	33.8	33.2
60+	19.6	24.2	13.4	22.1	23.7	20.9
Sex						
Male	48.8	47.2	47.7	48.4	48.6	48.2
Female	51.2	52.8	52.3	51.6	51.4	51.8
Race/ethnicity						
White	62.6	84.1	67.4	94.3	90.6	80.3
Black	12.0	6.9	26.2	1.5	1.4	8.3
Hispanic	5.2	2.3	2.2	1.6	2.2	2.5
Asian	13.9	1.3	1.5	1.5	2.9	3.7
American Indian	0.7	0.3	0.6	0.3	1.5	0.7
Other	8.9	5.7	2.1	1.0	2.4	3.2
Education						
<12 grade	4.6	7.7	6.3	9.7	8.8	7.6
High school grad	21.8	36.1	26.2	30.9	32.0	29.5
Some college	27.5	23.7	27.9	28.7	29.0	27.8
College grad	45.4	31.9	38.8	31.0	29.3	34.4
Income						
<$15,000	13.4	9.1	9.3	12.2	12.5	11.5
$15,000–$29,000	15.0	14.5	16.5	18.9	23.2	18.3
$30,000–$59,000	28.0	31.0	32.5	34.1	34.7	32.6
$60,000–$100,000	19.0	19.1	18.8	14.2	12.0	15.9
>$100,000	10.5	7.4	10.1	6.6	4.0	7.4
Residence						
City/urban	76.3	31.8	32.1	32.2	39.6	40.5
Suburban	17.5	42.8	56.7	29.3	23.9	33.0
Town/village	3.6	18.6	3.7	14.8	13.3	11.1
Rural (not farm)	1.1	5.3	5.6	13.6	14.6	9.4
Farm	0.4	0.5	0.7	9.3	7.7	4.9

Men and young adults may tend to engage in unsafe food-handling behaviors because they prepare fewer meals and therefore pay less attention to safety issues.

Although well-educated people and those with high income generally practice good health behaviors *(4, 19)*, we found that they were more likely to consume high-risk foods and take less time to handle food safely. People in the higher income brackets (>$100,000/year) were more likely to eat raw shellfish and undercooked hamburger and less likely to report washing their cutting boards after cut-

TABLE 2. *Consumption of high-risk food and food-handling behavior among the respondents by state (%)*

	California	Connecticut	Georgia	Minnesota	Oregon	Total
Consumption of raw milk	1.0	1.4	1.9	1.7	1.3	1.5
Consumption of raw shellfish	2.6	3.2	1.8	1.2	1.8	1.9
Consumption of runny egg	17.6	15.4	13.8	20.2	22.9	18.7
Consumption of alfalfa sprouts	10.6	4.5	5.8	6.5	10.1	7.6
Consumption of pink hamburger	13	17.5	9.8	9	6.9	10
Pink hamburger preference	38.5	43	29.2	30.4	19.4	30.5
Notice safe handling label	46.3	55.7	53.2	52.2	50.3	51.5
Read label	86.8	86.7	86.9	86.8	85.3	86.5
Do not always wash hands after handling raw meat or poultry	9.2	6.0	6.1	7.4	6.5	7.1
Do not always wash cutting board after cutting raw chicken	9.3	6.3	7.1	8.6	4.9	7.3

TABLE 3. *Food consumption and preference by demographic variables (%)*

	Consumption of raw milk	Consumption of raw shellfish	Consumption of runny egg	Consumption of alfalfa sprouts	Consumption of pink hamburger	Prefer pink hamburger
Age						
18–25[a]	2.4	3.0	13.3	8.8	8.9	32.7
25–40	1.5	2.4	15.9	8.6	8.7	34.1
40–60	1.5	1.2*	21.2*	7.9	11.9	31.9
60+	1.8	1.6*	22.2*	4.0*	9.4	20.6*
Sex						
Male[a]	2.1	2.7	21.9	7.3	12.2	35.1
Female	1.2*[b]	1.0*	15.6*	7.8	7.4*	25.9*
Race/ethnicity						
White[a]	1.5	1.7	19.2	7.5	10.1	32.5
Black	2.2	1.0	10.4*	4.9*	4.7*	10.1*
Hispanic	4.9*	7.3*	28.0*	12.3*	16.2	32.9
Asian	1.6	4.5*	20.7	10.0	11.0	36.6
American Indian	4.4	8.9*	15.2	6.7	9.1	17.5*
Other	2.8	2.6	14.5	6.5	15.1	21.6*
Education						
<12 grade[a]	4.0	2.2	21.9	6.1	9.6	18.5
High school grad	1.8*	1.4	21.0	4.5	8.5	24.7*
Some college	1.5*	1.8	19.4	7.3	9.9	30.7*
College grad	1.0*	2.1	15.3*	10.5*	11.4	38.1*
Income						
<$15,000[a]	2.6	2.5	22.7	6.9	6.5	20.8
$15,000–$30,000	2.1	1.2	20.2	5.8	7.9	23.2
$30,000–$60,000	1.8	1.6	20.0	7.5	9.4	29.7*
$60,000–$100,000	0.4*	1.4	16.4*	8.5	11.8*	40.0*
>$100,000	0.6*	2.6	14.5*	11.0*	15.3*	48.7*
Residence						
Urban[a]	1.1	2.4	17.4	7.6	9.5	29.8
Suburban	1.2	1.5*	17.2	7.5	10.6	34.7*
Town	1.3	2.0	20.4	8.6	10.1	27.1
Rural (not on a farm)	1.3	0.7*	25.4*	7.3	9.5	27.5
On a farm	8.6*	0.6*	21.2	3.6*	6.0	20.5*

[a] Referent group.
[b] Significantly different from the referent group, * $P < 0.05$.

ting raw poultry compared to people with low income. People with college education were more likely to eat undercooked hamburger compared to people with less than a high-school education. These findings are consistent with other studies *(1, 12, 21)*. One explanation is that people of higher socioeconomic status eat out more and prepare less food at home; alternatively, some high-risk foods, like raw shellfish and gourmet hamburgers, may be expensive or more a part of the culture of groups with higher socioeconomic status.

Undercooked eggs (runny eggs) were the most commonly consumed high-risk food, eaten by 19% of the respondents in the 5 days before the interview. Health education should emphasize the importance of cooking eggs well in order to prevent salmonellosis.

We found less consumption of high-risk foods, such as undercooked hamburger, raw shellfish, and undercooked eggs, than reported by Klontz et al. *(12)*. The difference between the two studies is in the time frame of consumption of these high-risk foods. We asked about consumption in the 5 days before the interview, while Klontz et al. asked "do you *ever* eat?" Another difference is that our survey was more recent; people may be more aware nowadays of the dangers of eating such risky foods and have changed their behavior accordingly.

Ninety-three percent of the respondents said they always or almost always washed their hands or cutting boards with soap and water after handling raw meat. This is higher than has been reported in other studies, where 80% reported washing their hands with soap and water and washing their cutting boards with soap/bleach after handling raw meat *(2, 12)*. This may reflect a recent change in behavior or differences in the way the questions were asked.

An important limitation of our survey is that it measured self-reported behavior, and respondents may have given what they thought was the right answer, rather than

TABLE 4. *Food-handling behaviors by demographic variables (%)*

	Notice safe handling label	Read label[a]	Do not always wash hands after handling raw meat	Do not always wash cutting board after cutting raw chicken
Age				
18–25[b]	50.4	81.3	12.1	11.1
25–40	60.6*[c]	85.4	6.7*	7.5*
40–60	57.6*	87.7*	6.5*	6.9*
60+	56.0*	90.5*	5.3*	4.5*
Sex				
Male[b]	46.7	83.0	11.3	11.0
Female	66.5*	88.7*	3.5*	4.1*
Race/ethnicity				
White[b]	57.4	86.6	6.6	6.9
Black	57.6	84.5	7.6	8.1
Hispanic	56.6	82.7	11.3*	11.5
Asian	52.0	84.5	10.5	8.0
American Indian	61.5	91.7	2.7	0
Other	53.4	89.2	12.0*	8.2
Education				
<12 grade[b]	53.5	82.0	8.3	6.9
High school grad	56.0	87.0	6.0	6.1
Some college	57.7	88.4*	7.4	7.5
College grad	58.6	85.5	7.4	8.0
Income				
<$15,000[b]	58.6	86.1	7.2	7.6
$15,000–$30,000	56.5	87.6	6.2	6.9
$30,000–$60,000	59.2	87.5	6.3	6.7
$60,000–$100,000	55.9	83.2	8.1	6.8
>$100,000	52.0	85.1	9.2	13.9*
Residence				
Urban[b]	58.5	86.5	7.3	7.3
Suburban	58.3	86.1	5.6*	6.6
Town	55.0	86.1	7.6	7.5
Rural (not on a farm)	51.8*	87.9	10.7*	8.1
On a farm	53.0	87.1	6.4	6.9

[a] Among those who noticed the label.
[b] Referent group.
[c] Significantly different from the referent group, * $P < 0.05$.

having reported their true behavior. Presumably due to highly publicized outbreaks (e.g., the large hamburger-associated outbreak of *E. coli* O157 infection in western states in 1992 to 1993 *(3)*), regulatory action (e.g., the banning or severe restriction of the sale of unpasteurized milk in many states), and educational efforts (e.g., the posting of safe food-handling labels on meat and poultry *(11)*), the majority of adults in our survey seem to have heard many of the food-safety messages that we consider most important. However, many still consume high-risk foods or handle food in a less-than-safe manner. Moreover, our survey figures, unvalidated by observation, are likely to underestimate the true rate of unsafe practices, because a natural tendency for respondents would be to recall their safe practices and gloss over unsafe ones.

Although there were statistical differences in high-risk food consumption and food-handling behaviors among the different demographic groups, they are probably insufficient to warrant targeted education campaigns; rather, food-safety education needs to be delivered to all consumers. We believe that knowledge of microbial disease and its relation to food safety, along with a small number of key food preparation messages could be incorporated into high-school biology or health classes without sacrificing other important learning objectives.

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